



Original Article

Knee injury and osteoarthritis outcome score of Korean national ice hockey players

HYEYOUNG KIM, MSc, PT^{1, 2)}, SUJIN HWANG, PhD, PT³⁾, BYOUNG-HEE LEE, PhD, PT⁴⁾*

¹⁾ Department of Sports Medicine and Science, Taereung National Training Center, Republic of Korea

²⁾ Graduate School of Physical Therapy, Sahmyook University, Republic of Korea

³⁾ Department of Physical Therapy, Baekseok University, Republic of Korea

⁴⁾ Department of Physical Therapy, Sahmyook University: 815 Hwarangro, Nowon-gu, Seoul 139-742, Republic of Korea

Abstract. [Purpose] To investigate sports injuries in Korean national ice hockey players by surveying parts, times, types, frequency, cure, and prevention types of sports injuries and provide basic data for injury prevention and performance improvement of ice hockey players. Another purpose of this study was to evaluate the incidence of ice hockey injuries according to age and the relationship between etiological factors and injuries in high school students. [Subjects and Methods] This was a cross-sectional study. Eighteen female ice hockey players in Korean elite athletes were recruited for this study. This study was conducted by a self-administered questionnaire survey using Knee Injury and Osteoarthritis Outcome Score (KOOS) of national ice hockey players. [Results] Participants were injured mainly during training. Injuries were caused by skate, puck-contact, and body check. Five subscales of KOOS were significantly correlated with each other except that the correlation between activities of daily living and quality of life was insignificant. [Conclusion] For injury prevention in national team ice hockey players, full gear is recommended. In addition, therapist in the field needs to conduct injury prevention through consistent observations and counseling in order to prevent injury and improve performance. Ice hockey players also need sufficient rest with systematic and scientific training for injury prevention and performance improvement.

Key words: Ice hockey, Sport injury, Prevention

(This article was submitted Apr. 24, 2017, and was accepted Jun. 8, 2017)

INTRODUCTION

Elite athletes are exposed to fatigue with high risk of various injuries because they spend most of their waking time in skillful performance. Sports injury is defined as body injury in relation to sports. It causes disability in daily life and reduces enthusiasm for exercise. It is the major factor behind declines in athletes' performance¹⁾. Particularly, ice hockey is an exciting game for skillful players. However, aggressive play and fighting during play can cause injuries involving physical and psychological factors such as unintended physical collisions, high speed, rapid directional changes on hard ice, and traumas from board, stick, or puck²⁾.

In professional ice hockey, major injuries are caused by head hits and fighting. It has been reported that sports-related concussion and brain injury in appropriately 80% of athletes can be resolved within 10 days³⁾. Facial injuries and concussion have been reported in a wide variety of injuries in ice hockey. However, the risk, type, mechanisms and severity of ice hockey injuries in professional ice hockey players have not been well studied. Disabilities and pains in knee joint have been rarely described in professional hockey players, although they have been often described in other elite athletes such as professional football and basketball players. There is insufficient information quantifying the effect that a dysfunctional knee joint has

*Corresponding author. Byoung-Hee Lee (E-mail: 3679@syu.ac.kr)

©2017 The Society of Physical Therapy Science. Published by IPEC Inc.



This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial No Derivatives (by-nc-nd) License. (CC-BY-NC-ND 4.0: <https://creativecommons.org/licenses/by-nc-nd/4.0/>)

Table 1. Pain-related characteristics of the participants (N=18)

No	Position	VAS	Timing	Cause	Effects of injury on skill	Effect of injury on training
1	Centre	7	During training	Skate	4	2
2	Centre	4	During training	Weight training	3	3
3	Centre	2	During training	Check from behind	2	1
4	Centre	3	During training		1	1
5	Defense	3	During competition	Body check	5	4
6	Defense	2	During training	Puck contact	1	1
7	Defense	6	During training		2	2
8	Defense	7	During training	Skate	2	2
9	Defense	7	During training	Skate	2	2
10	Defense	4	During training	Stick contact	3	2
11	Goalie	6	During training	Goalie task	4	2
12	Goalie	3	During training	Leg splitting	4	2
13	Wing	7	During training	-	4	2
14	Wing	7	During training	Non-contact	3	2
15	Wing	2	During training	Puck contact	3	3
16	Wing	2	During training	Puck contact	2	1
17	Wing	4	During training	Skate	1	1
18	Wing	1	During competition	Body check	1	1

VAS: visual analogue scale

on professional hockey players. Therefore, the purpose of this study was to assess the incidence, nature, causes, and severity of national ice hockey injuries and evaluate the relationships among pain, symptom, activities of daily living, sports or recreation, and quality of life using a clinical measurement tool in national ice hockey players of Korea.

SUBJECTS AND METHODS

A total of eighteen national ice hockey players who were admitted at Korea National Training Center in Taerong participated in this study. They signed consent forms spontaneously. This study examined 18 females. Their mean age, height, body weight, upper extremity weight, head weight, and body mass index (BMI) were 19.68 years, 161.07 cm, 59.16 kg, 32.72 kg, 4.76 kg, and 22.21, respectively.

The study was carried out in accordance with the International Ethical Guidelines and the Declaration of Helsinki. It was approved by Institutional Review Board of Sahmyook University (Approval No.: 2-1040781-AB-N-01-2016068HR).

This study examined the correlation between two clinical measurements. Knee Injury and Osteoarthritis Outcome Score (KOOS) is a self-administered assessment for short- and long- term patient-relevant outcomes following knee injury for athletes, knee injury, anterior cruciate ligament, post traumatic osteoarthritis, and total joint replacement. The tool is based on Western Ontario and Mc-Master Universities Osteoarthritis Index. It has a total of 42 items within five sub-items, including pain (9 items), symptoms (7 items), activities of daily life function (17 items), sport and recreation function (5 items), and knee-related quality of life (4 items). Each item is scored from 0 (no problem) to 4 (extreme problem). The score ranges from 0 to 100, with higher scores indicating better status. All KOOS subscales had Intra-class Correlations Coefficients (ICC) higher than the acceptable level of 0.70 (range, 0.75 to 0.93). Cronbach's alpha was higher than 0.70 in all KOOS subscales in competitive athletes⁴.

Descriptive statistics was performed for demographic characteristics and pain-related characteristics of participants such as age, height, weight, weight of upper extremity, weight of head, body mass index, position in play team, visual analogue scale, pain-related timing, cause, effects of injury on skill, and effect of injury on training. To analyze test-retest reliability of the KOOS, this study used ICC. Pearson correlation analysis was performed in this study to analyze interactions among all KOOS subscales. All statistical analyses were performed using PASW version 18.0 for Windows (SPSS Inc., Chicago, IL, USA). A p-value of equal to or less than 0.05 was considered statistically significant for correlations.

RESULTS

Pain-related characteristics of participants are shown in Table 1. They suffered pain-related injuries mostly during training, followed by those during competition. They reported that causes of injury were from skate, puck-contact, body check, stick contact, goalie task, and weight training.

Correlations among the five subscales of KOOS were significant. Pain was significantly correlated with symptom (0.614), activities of daily living (0.741), sports/recreation (0.831), and quality of life (0.721). Symptom was significantly correlated with pain, activities of daily living (0.524), sports/recreation (0.511), and quality of life (0.601). Activities of daily living was also significantly correlated with pain, symptom, and sports/recreation (0.843), but not significantly correlated with quality of life. Sports /recreation was significantly correlated with pain, symptom, activities of daily living, and quality of life (0.505).

Table 2. Correlations between sub-items of KOOS (N=18)

	Pain	Symptom	Activities of daily living	Sports/recreation	Quality of life
Pain		0.614**	0.741**	0.831**	0.721**
Symptom	0.614**		0.524*	0.511*	0.601**
Activities of Daily Living	0.741**	0.524*		0.843**	0.381
Sports/Recreation	0.831**	0.511*	0.843**		0.505*
Quality of Life	0.721**	0.601**	0.381	0.505*	

*p<0.05; **p<0.01

Quality of life was significantly correlated with pain, symptom, and sports/recreation (Table 2).

DISCUSSION

The purpose of this study was to assess national ice hockey injuries and evaluate the relationship among pain, symptom, activities of daily living, sports or recreation, and quality of life using a clinical measurement tool in national ice hockey players. Main findings of this study were as follows: (1) Participants were injured mainly during training due to skate, puck-contact, and body check; (2) Correlations among the five subscales of KOOS were significant except that activities of daily living and quality of life were not significantly correlated.

Professional ice hockey players are associated with high rates of injuries, particularly traumatic brain injury. Previous studies have focused on traumatic brain injury such as concussion and loss of consciousness in other athletes. However, very few studies have reported injuries in professional ice hockey players^{5,6}. Particularly, ice hockey players tend to start playing hockey relatively early compared to other competitive sports. Therefore, professional ice hockey players should be studied to prevent ice hockey-related injuries or disabilities in their sports activities. This study measured knee joint-related injuries such as pain, symptom, activities of daily living, sports/recreation, and quality of life using KOOS. This study also measured pain-related characteristics such as visual analogue scale, pain-related timing, cause, effects of injury on skill, and effect of injury on training. Warch and colleagues have systematically examined the risk of injury associated with body checking in youth ice hockey players⁵. They reviewed twenty studies according to increased injuries associated with body checking and reported that the relative risk of injury associated with body checking as the mechanism of injury accounted for 2.9% to 91% of injuries⁵. They also suggested policies to disallow body checking to reduce injuries for youth ice hockey⁵. In the present study, two players out of eighteen participants also reported that body check during competition was the cause of their injuries. This study also measured knee joint-related signs and symptoms. Results of this study showed that knee pain and symptom, activities of daily living, sports/recreation, and quality of life in professional ice hockey players had significant correlations. Our results suggest that knee joint management is required in order to maintain and improve the performance of professional ice hockey players.

The KOOS is intended to measure post traumatic knee injury such as anterior cruciate ligament injury, meniscus injury, and chondral injury. It has been used to monitor groups and individuals over time. The score of the KOOS has been proven to be a measure with sufficient reliability, validity, and responsiveness for surgery and physical therapy after knee injury. Results of this study showed that the most sensitive and response subscales were knee-related pain, symptoms, activities of daily living, sports and recreation function, and quality of life. This study provides evidence that knee injury-related dysfunction in professional ice hockey players during training or competition needs to be assessed. However, this study did not consider injuries to other segments in the body such as hip joint, foot ankle, or neck. It only examined knee joints. Therefore, further studies are needed to determine short-term and long-term effects of knee injuries in professional ice hockey players using KOOS.

Conflict of interest

Financial disclosure statements have been obtained, and no conflicts of interest have been reported by the authors or by any individuals in control of the content of this article.

REFERENCES

- 1) Kim H, Chung E, Lee BH: A comparison of the foot and ankle condition between elite athletes and non-athletes. *J Phys Ther Sci*, 2013, 25: 1269–1272. [Medline] [CrossRef]
- 2) Benson BW, Meeuwisse WH: Ice hockey injuries. *Med Sport Sci*, 2005, 49: 86–119. [Medline] [CrossRef]
- 3) Langlois JA, Rutland-Brown W, Wald MM: The epidemiology and impact of traumatic brain injury: a brief overview. *J Head Trauma Rehabil*, 2006, 21: 375–378. [Medline] [CrossRef]
- 4) Salavati M, Akhbari B, Mohammadi F, et al.: Knee injury and Osteoarthritis Outcome Score (KOOS); reliability and validity in competitive athletes after anterior cruciate ligament reconstruction. *Osteoarthritis Cartilage*, 2011, 19: 406–410. [Medline] [CrossRef]
- 5) Warsh JM, Constantin SA, Howard A, et al.: A systematic review of the association between body checking and injury in youth ice hockey. *Clin J Sport Med*, 2009, 19: 134–144. [Medline] [CrossRef]
- 6) Marchie A, Cusimano MD: Bodychecking and concussions in ice hockey: should our youth pay the price? *CMAJ*, 2003, 169: 124–128. [Medline]